Poster Title: Increasing Efficacy and Decreasing Application Rate of Telone C35 with Carbonation and Low Permeable Films

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Introduction

The main thrust of this research is to find a low-cost, readily available alternative to methyl bromide (MeBr) that meets the needs as put forth in the 2011 Critical Use Nominations (CUNs) and the USDAοs Crop Profiles and Pest Management Strategy Plans (PMSP) along with the Integrated Pest Management (IPM) roadmap. Alternatives to MeBr must control three major areas of potential damage to crop production. Since MeBr can control weeds, phytopathogenic fungi, and nematodes, any alternative must do the same. Currently, no single chemical or non-chemical method can exhibit the efficiency of MeBr in these areas (Yates *et al.*, 2002).

Due to hard economic times, restrictive buffer zones, fumigant limitation by township caps in some areas, and the phase-out of MeBr, it has become imperative that the alternative pre-crop fumigants, 1,3-dichloropropene (1,3-D) and chloropicrin (PIC), be used as sparingly and effectively as possible. The carbonation of these fumigants (1,3-D and PIC) allows for faster and more even sub-surface distribution. This, in turn, means less fumigant needs to be applied. Growers or applicators can easily carbonate fumigants by adding carbon dioxide (CO_2) to the fumigants twenty-four hours prior to application and using CO_2 as a dispersant with existing fumigation equipment. the use of Totally Impermeable Films (TIFs) should severely cut back on emissions compared to Virtually Impermeable Films (VIFs). The use of TIFs with appropriate herbicides combined with reduced amount of 1,3-D and PIC could be economical for the growers who are seeking to control weeds, nematodes, and phytopathic fungi.

Objectives

This projectοs long-term goals are: 1) to reduce the application rate of fumigation through a combination of extremely low permeability films (retention) and carbonation of the active ingredients (better dispersion) and 2) to ascertain the lowest fumigation rate required to be effective in a variety of soils with a variety of crops.

The expected outcome is an economically feasible alternative to MeBr that should reduce emissions, buffer zones, and the amount of fumigant per acre. The information generated will lead to training and adoption of new techniques for county extension agents, future scientists and educators, as well as other stakeholders.

Materials and Methods

Field site and chemicals. Commercial Telone C35 and analytical grade (Z)- and (E)-1,3-D and chloropicrin (CP) were provided by Dow AgroScience (Indianapolis, IN). XAD-4 resin sampling tubes were used to trap (Z)- and (E)-1,3-D plus CP in air. The field site used for this study was located at the Plant Science Research and Education Unit, University of Florida about 35 km south of the university campus. Soil at this site is classified as Arredondo fine sand.

Plots and fumigant treatment. Research on low permeable mulches with pre-crop fumigation were investigated at the Plant Science Education and Research Unit operated by the University of Florida near Citra, FL during Spring 2011. Raised beds (0.9 m by 10 m) were established in area known to exhibit nematode and nutsedge pressure. For the Spring 2011 trial, chisel injection of Telone C35 was done at a depth of 30 cm using the full rate of 35 gallons per acre with N_2, and one-third rate of 12 gallons per acre with N_2 and CO_2. The Telone C35 dispersed with CO_2 was carbonated at ambient temperature for 18 hours at 50 psi through the fumigant tankôs siphon tube and applied 48 hours later. Control beds with no fumigation were established concurrently. All plots were done in quadruplicate using random block design. Plots were either covered by TIF (Raven Plastics, Sioux Falls, SD) or VIF (Berry Plastics, Evansville, IN).
Sampling. For sampling soil pore air, a set of 7 different lengths of stainless steel gas probes (1, 5, 10, 20, 30, 40, and 60 cm) were installed length-wise in the middle of each bed. In addition, six more 20-cm long gas probes were installed every 10 cm perpendicular from the center 20 cm probe to span the width of each bed. Thirty-five mL of soil pore air was withdrawn from the probes with CP and (Z)- and (E)-1,3-D in the air samples trapped by the XAD-4 sampling tubes. A stainless steel surface air collection pan was placed on the surface of each metallic PE bed for determination of surface flux of CP and (Z)- and (E)-1,3-D. Fifty mL surface air in the pans was collected at 15 minutes intervals for a period of 60 minutes with CP and (Z)- and (E)-1,3-D in the air samples trapped by XAD-4 resin.
Analysis. **(**Z)- and (E)-1,3-D plus CP in the XAD-4 tubes collected from soil pore and surface air were analyzed by GC equipped with ECD after extraction by 5 mL hexane with 5 minutes shaking (Thomas et al. 2004).

Conclusions

1) The carbonation of Telone C35 resulted in the fumigant reaching a greater depth than the C35 applied by N_2. This should reduce the nematode re-infestation of the bed from below.
2) The carbonation of Telone C35 caused greater lateral movement than observed by Telone C35 dispersed by N_2. Additionally, the dissipation of carbonated Telone C35 was faster than the Telone C35 applied by N_2 which implies that the plant-back time may be shortened.
3) Weeds puncturing the plastic film on the beds were greatly reduced by the TIF compared to VIF.
4) Root galling index implied that there was very little difference in nematode control between carbonated and non-carbonated Telone C35 when applied at the same rate. However, it should be noted that the plots treated with reduced 1/3 rate of Telone C35 by N_2 had better nematode control than those plots treated at the full rate of Telone C35 by N_2. It was later confirmed that field was infested with *Pasteuria penetrans*, an obligate parasite of nematodes (Dr. Don Dickson, private communication). Field variability of infestation is probably indicated by the large error bars.
5) Marketable crop yield for plots treated with carbonated Telone C35 were slightly greater than the Methyl Bromide plots or the plots treated by Telone C35 dispersed by N_2, but not significantly so.

References

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